LiPoRx Operating instructions

Dear customer,

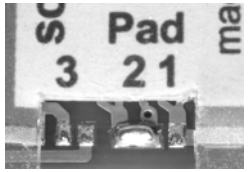
Congratulations on your choice of this modern two-cell Lithium receiver battery, which incorporates a stabilisation circuit which can be set to any of three output voltages. It also features a push-button controlled FET On / Off switch, a compensated battery state indicator, a cell balancer and a data logger.
The LiPoRx makes an important contribution to greater safety in modelling, and should be considered as a basic necessity in all your larger models.
The On / Off switch is wear-free, permanently immune to contact problems, and offers low resistance.
The power supply cables are of generous dimensions.
The battery state indicator shows correct readings under load as well as under no-load conditions (idle state).
The integral data logger is an important and useful aid to the modeller, confirming that you have selected the appropriate type of LiPoRx, and detecting overload conditions in terms of temperature, current and operating times.

1 Set-up options

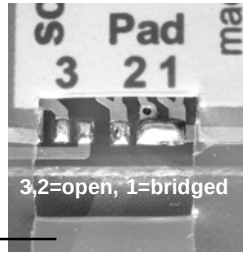
You can select any of three different stabilised output voltages using the two solder bridges on the circuit board. If you set a higher receiver voltage, the servos offer more power and run faster.
If necessary cut a flap in the heat-shrink sleeve using a sharp blade - taking care not to damage the circuit board or the battery.

Solder bridge 1	Solder bridge 2	Output
1 = open,	2 = bridged	5,0 Volt
1 = bridged,	2 = open	5,3 Volt
1 = open,	2 = open	5.7 Volt

Please read the instructions and data sheets supplied with your receiver and servos before setting the receiver voltage to a high value.



3,1 = open, 2 = bridged
Flap of heat-shrink sleeve folded up



2 Connections

The LiPoRx features several integral leads.
• One lead fitted with a charge socket.
• Two conventional parallel-wired "servo leads" of large conductor cross-section, fitted with 1 Amp continuous current sockets suitable for the output voltage selected above.
• One high-current receiver power supply lead of large conductor cross-section, fitted with a high-current socket (5 Amp continuous current) for the output voltage selected above (not fitted to the 910 mAh types).

Note: the cables are of large cross-sectional area and relatively short, so the LiPoRx must be installed close to the receiver for reasons of operational security. The cables should never be extended, but if there is absolutely no alternative: use cable of 0.34 mm², and solder the joints - do not use a standard extension lead, because the connectors are unreliable.

3 Control module

The LiPoRx is equipped with a removable control module. The control module includes:
• Two operating buttons (On and Off buttons)
• One RGB LED capable of displaying all colours, including white
• Various front plates, fixings and sticker

4 Installing the battery (with electronics) **and the control module**

4.1 **The LiPoRx should be mounted in the fuselage close to the receiver, e.g. using self-adhesive Velcro** (hook-and-loop) tape (use a type with strong adhesive). Cable ties can be used for additional security. Don't forget a foam rubber strip for distributing the load into the LiPoRx module.

4.2.1 **Flush-/recessed mounting of the front plate of the of the control module in a thick fuselage side.**
a) Cut out a rectangular opening in the fuselage side, 36 * 13 mm in size (use template).
b) Screw a front plate to the LiPoRx control module via the 4.5 mm spacer, using the fixings supplied.
c) Install the control module from the outside and glue or screw the front plate to the fuselage side using the supplementary outer holes.
d) Apply one of the stickers provided; ensure that the text is legible, and that it covers the front plate exactly.
e) Connect the control module to the battery electronics via the 8-pin connector.

4.2.2 **Flush-/recessed mounting of the front plate of the control module in a thin fuselage side** (without illustration).
a) Cut out a rectangular opening in the fuselage side 36 x 13 mm in size (use template).
b) Hold one front plate on the outside of the opening and another front plate on the inside, fit the screws through the screw-holes, fit both 4.5 mm long spacers over the screws, and then fit the control module on them inside the fuselage. Tighten the screws. If the front plate is not secure enough, it can be glued to the fuselage as described in 4.2.1, or screwed in place using the supplementary mounting holes.

c) Apply one of the stickers provided; ensure that the text is legible, and that it covers the front plate exactly.
d) Connect the control module to the battery electronics via the 8-pin connector.

4.2.3 **Proud mounting of the control module on the outside of the fuselage.**
(adopt the following sequence and use two M 2 x 18 screws)
a) Front plate,
b) 4.5 mm long spacers,
c) Control module circuit board,
d) 7.0 mm long spacers,
e) Front plate,
f) M2 self-locking nut.
g) - If necessary, drill holes into the fuselage to recess the two M2 self-locking nuts, otherwise fill out, e.g. with scrap balsa.
- Glue the control module to the outside of the fuselage.
h) Connect the control module to the battery electronics via the 8-pin connector.

5 Using the system for the first time / displays / indicators

5.1 The LiPoRx is switched on using the ON button, which must be held pressed in for about 0.8 seconds. When you first press the button, the battery state indicator glows green to confirm the button-press. If the indicator glows red, you have accidentally pressed the OFF button.
After the 0.8 second period, the battery state indicator flashes; the LED will always glow green as long as the button is held pressed in. The power supply to the receiver is now switched on.

5.2 Since the discharge curve of the LiPo battery is known to the LiPoRx, the battery state indicator now flashes in accordance with the colour sequence depicted on the front plate, i.e. from white (full) via blue, green (about 50%), yellow to red (flat).
The display is not a "simple" display of the battery voltage. Since the LiPoRx is aware of the current drain of the receiving system, the indicator is maintained at a constant colour even though the current load may fluctuate widely according to the servos in use. This is possible because the internal resistance of the LiPo battery cells is known.

5.3 The LiPoRx is switched off using the OFF button. This must be held pressed in for about two seconds. When you first press the button, the battery state indicator glows red to confirm the button press. If the indicator glows green, you have accidentally pressed the ON button.
After the two-second period, the battery state indicator goes out, and the receiver power supply to the receiver is interrupted.

6 Recharging the LiPo battery / indicators

The LiPoRx is charged via the two-pin "slow-fly" connector.
In charge mode the receiver voltage is switched off.

6.1 The charger must be set to two LiPo cells and a charge rate of "1C". This means:
• For the LiPoRx-910.x 910 mA (800 … 1000 mA)
• For the LiPoRx-2000.x 2 A
• For the LiPoRx-3200.x 3.2 A (3 A … 3.5 A)

6.2 The LiPoRx must deliberately be set to charge mode for charging.

6.2.0 The LiPoRx must first be switched off (OFF button), if it is not already off.

6.2.1 Charge mode is selected by holding both buttons pressed in for minimum 0.8 seconds, after release of the buttons the battery state indicator starts flashing. The flashing colour alternates between a) green (=charge mode), b) dark, c) display of charge state (=appropriate colour), d) dark, a) green …

6.3 After a longer period the battery is fully charged.

6.3.1 The charger switches the charge current off, and displays "full" or a similar message.
At the end of the charge process the user should switch charge mode off using the OFF button.
This is accomplished by holding the OFF button pressed in for two seconds - until the charge state indicator goes out.
If you neglect to do this, the LiPoRx switches charge mode off one hour after the charger displays the "full" message, thereby disconnecting the battery from the charger.
The charger will then display the message "battery disconnected" or "ready" or "…" according to charger type.

6.3.2 If you disconnect the charge lead during the charge process, the LiPoRx detects the same situation as under 6.3.1 ("no charge current"), and also responds identically: after one hour it switches charge mode off.

6.3.3 The user can also halt the charge process at any time using the OFF button.

Hold the OFF button pressed in for two seconds: until the charge state indicator goes out.

7 Protective circuits

The LiPoRx monitors the charge / discharge current during the discharge and charge processes.

7.1 If an excessive charge rate is set at the charger, the charge process is interrupted, and the LiPoRx sets itself to OFF.

7.2 If the wrong charge mode is set on the battery charger (incorrect cell count or a Nickel battery charge program instead of the LiPo charge program), then the charge process is halted at the moment when the battery exceeds the maximum permissible charge voltage for the battery. The LiPoRx sets itself to OFF.

7.3 The LiPo battery can also be discharged via the charge socket. The protective circuit prevents excessive discharge currents. The LiPoRx sets itself to OFF.

8 Battery maintenance

The voltage of the two LiPo battery cells is constantly balanced - if necessary - regardless of their state of charge. The principle employed is the "smart balancing" method, which has already proved excellent in our LiPoCard and LiPoBalancer, as it minimises unnecessary cell balancing at different states of charge.

9 Data logger function: recording

Although the normal function of the LiPoRx is to supply power to the receiving system, it also includes a vitally important feature which is not offered by conventional receiver batteries: the data logger, which records everything relevant to your receiving system's power supply.

9.1 • All data is initially (when the data memory is cleared) determined at one-second intervals.
• The average value of the data within this time period is stored, as is the peak value (e.g. the maximum current and the minimum voltage).
• If there is a risk of memory overflow during the recording period, the data is compressed, i.e. two adjacent average voltage values are replaced by the average of these two values, or the larger of two adjacent peak current values is retained.
• The internal data memory is not erased until you change the operating mode; this means that the data is stored permanently until the operating mode is changed (switched from receiver power supply mode to charge mode, or vice versa). Switching the receiver power supply off does not constitute a mode change; it simply interrupts the data recording process. If an interruption occurs - e.g. a new flight without recharging the battery - the seconds are zeroed, but the earlier data is not erased.

9.2 Data recording with the receiver power supply switched on.
When the LiPoRx is switched on, the following data is recorded:
a) Minimum receiver voltage, b) Average receiver voltage,
c) Maximum receiver current, d) Average receiver current,
e) Temperature, especially of the voltage stabilisation circuit.

9.3 Data recording during battery charge mode.
When charge mode is activated, the following data is recorded:
a) Average charge voltage, b) Average charge current,
c) Voltage of cell 1, d) Voltage of cell 2,
e) Temperature of the LiPoRx circuit board with the battery bonded to it.

10 Data logger function: data transfer

10.1 The recorded data can be transferred from the LiPoRx to the RS 232 port of a PC using the ***prog-adapt-alpha*** adaptor and the ***prog-adapt-uni*** lead.
If you wish to use a laptop with only a USB port, then you will require the ***RS232-USB-adapt***or.
At the PC / laptop end the data is received by the ***winsoft*** or ***AkkuSoft*** software, both of which can be downloaded from our website (Section C1).

10.2 Preparing for data transfer

• Run the analysis program on the PC or laptop (***winsoft*** or ***AkkuSoft***).
• We recommend that you select "File", "Store original data in file" for storing the data from the LiPoRx.
• Open the "battery 1 Online" window with the following "Settings" under "Curve select battery 1":
Voltage, Current, Capacity, Temperature, 7 cell voltage
• To check the data arriving you can open the "Info", "Online info" window.
• Connect the adaptor (stated under 10.1. - ***RS232-USB-adapt, pro-adapt-uni, pro-adapt-alpha***) to the PC or laptop - but not yet to the LiPoRx.

• Select the appropriate port in the analysis program, and activate the port ("Connect").
• Pull out the 8-pin plug (the one with the 6-core ribbon cable) from the LiPoRx.
• Refer to the photo sheet and check that you know how to connect the 6-pin ***prog-adapt-alpha*** to the 8 pins of the LiPoRx control module plug with correct polarity - but don't connect it yet.

10.3 When you have carried out all the preparatory steps listed under 10.2, connect the ***prog-adapt-alpha*** to the connector on the LiPoRx control module.
• Ensure that the plug is connected to the correct six pins.
• Data transfer commences automatically when you plug in the ***prog-adapt-alpha***. If you interrupt the data transfer by disconnecting the ***prog-adapt-alpha*** from the ***LiPoRx***, the data transfer starts again from the beginning when the connection is restored.
• The data is immediately displayed in the opened Battery 1 diagram in the analysis program.

10.4 Key to the curves in the receiver battery data output diagram

a) Average receiver voltage = "Voltage" curve
b) Average receiver current = "Current" curve
c) Minimum receiver voltage = "V12 voltage cell 3"
d) Maximum receiver current = "V12 voltage cell 4" (= current value)
e) Voltage stabilisation circuit temperature = "Temperature"

10.5 Key to the curves in the charge data output diagram

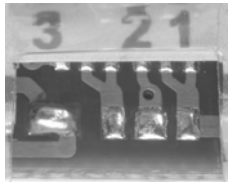
a) (Average) charge voltage = "Voltage" curve
b) (Average) charge current = "Current" curve
c) Voltage of cell 1 = "V12 voltage cell 1"
d) Voltage of cell 2 = "V12 voltage cell 2"
e) Temperature of circuit board = "Temperature"

10.6 Practical use of the diagram curves

You can make use of the curves to work out the appropriate capacity of the receiver power supply for a particular model, as well as to check the loads which occur in that model.
• For example, if you find that peak currents of 7 Amps occur constantly with a 4 A LiPoRx, then you should consider switching to the 7 A type.
"Since the energy consumption display in mAh is relatively accurate, it is possible to calculate the safe operating time with a fully charged receiver battery after a test-flight (i.e. by multiplication)."

11 Special notes

As the **LiPoRx** is connected to the battery "all year round", it could deep-discharge the pack even though its "sleep" current is extremely low. If you have a discharged LiPoRx-910, the maximum period of storage before recharging is three weeks; the corresponding figure with a full pack is around five months. With higher-capacity LiPoRx versions the safe storage periods are commensurately longer. If a battery should become deep-discharged, then the LiPoRx can be recharged at a very low current (1/10 C) by closing the solder bridge #3. When the pack reaches a voltage at which the micro-processor is able to function again, the battery state indicator will flash red at a fast rhythm (lilac flashing means: it is not full enough). This is intended to alert you to the fact that the closed solder bridge is by-passing all the protective circuits, and that the solder bridge must now be opened again.



3= soldered; 2,1= open

12 Specification

Type Order designat.	Kapacity [mAh]	Nom./ Con./ Peak Current about [A]			Weight [g]	Dimensions [mm]
LiPoRx-910.4	910	4	3,5	6	77	84 * 35 * 16
LiPoRx-910.7	910	7	3,5	10,5	77	84 * 35 * 16
LiPoRx-2000.4	2000	4	3,5	6	136	95 * 40 * 22
LiPoRx-2000.7	2000	7	3,5	10,5	136	95 * 40 * 22
LiPoRx-3200.4	3200	4	4	6	205	150 * 40 * 20
LiPoRx-3200.7	3200	7	4	10,5	205	150 * 40 * 20

Colour sequence of the battery state indicator LED:

From white (full) via blue, green (approx. 50%), yellow, violet to red (flat).

Size of circuit board (excl. battery)	75*35*4 mm
Size of On / Off module incl. LED	35*12*6 mm
Size of front plate, On / Off module	55*20*1 mm
Maximum voltage of safety power-off	60 V
"OFF" current drain about	350 µA

Connecting leads, length about 16 cm:
1 * charge lead
2 * power servo lead, 0.34 mm² (1 A continuous)
1 * high-current connector (5 A continuous)
(not fitted to LiPoRx-910.x)

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www.schulze-elektronik-gmbh.com • Germany • hotline@schulze-elektronik-gmbh.com

Important common hints to lithium batteries

13 Common hints on using Lithium batteries

- Do not disassemble, modify, heat or short-circuit the battery.
- Do not burn the battery or store it in a hot area.
- Do not drop the battery and/or apply excessive mechanical stress to it.
- Do not allow the battery to get wet.
- Observe chapter 6.
- Use for charging with the LiPoCard the selections „LithiumPolymer“ and „2 cells“ and 1 C charging current (suitably the capacity of the LiPoRx batteries) or a battery charger with a charge program for Lithium batteries.

13.1 Charging instructions

- Lithium batteries must not be charged using any charger or charge program which was intended for Nickel batteries (Ni-Cd or NiMH). These batteries must only be charged using a specialised unit such as the ***Schulze LiPoCard***, or a charger such as the ***Schulze isl 6*** or ***isl 8 series***; these devices include programs for charging Lithium batteries.

FIRE HAZARD! - if you do not observe the battery manufacturer's charging instructions, you risk damaging and even ruining the batteries (swelling, explosion); this can result in fire.

In particular please remember that the number of cells in the pack must be set correctly on the charger; note: this applies only to the number of cells wired in series. Parallel-wired cells are “seen” by the charger simply as one (1) cell “of large capacity”.

- Before charging the cells it is essential to check the cell count setting and the maximum charge voltage on the charger.
- Before charging the cells it is essential to check the maximum charge current setting.
- Keep the battery well away from inflammable materials and volatile gases.
- During any charge / discharge process the charger / discharger and the the connected batteries (in the LiPoRx) must be placed on a non-inflammable, heat-resistant and electrically non-conductive surface. Such surfaces include ceramic dishes and flower pots, and special fireproof plastic or aluminium cases (these must be insulated, e.g. using plaster sheets).
- Don't charge batteries in the car - the seats burn very well …
- Supervise the charge/discharge process constantly - if the battery swells up, disconnect it from the charger immediately.
- Burning batteries should be extinguished with dry sand or a powder fire extinguisher - never with water - possibly explosion hazard!
- Never attempt to recharge dead or damaged cells - this can have particularly disastrous results if these cells are part of a pack which also includes “healthy” cells.
- Protect the cells from mechanical loads!

13.2 Useful life

- Observe the charge current and discharge current limits stated by the battery manufacturer. Do not exceed the maximum values, as this brings a risk of drastic reduction in the pack's useful life.
- Contrary to much published information, the professional protective circuit for Kokam cells defines the lower and upper limits as 1.0 and 4.5 Volts per cell (http://www.kokam.com/english/biz/care.html). The protective circuits in the LiPoRx are not so close to the extremes as written above.
- The most common cause of unbalanced battery packs is not “deep-discharging” to below 3 V / cell, but overloading through excessive discharge currents!
- Lithium cells lose a small amount of capacity every time they are charged, but the loss is much higher if they are overloaded.
- Make sure your batteries are protected from short-circuit at all times! Whether the “short” is caused by a screwdriver in your toolbox or by a house-key in your trouser pocket, the result is the same: overloaded cells, and possibly a fire.

- If you deep-discharge a battery at a high current to a point below 1 V / cell, the result is invariably irreparable damage. In any application where high motor currents are used, the discharge limit for packs of identical cells must be in the range 2.4 … 3.0 V / cell. If the pack includes cells in different conditions, the discharge limit should be set even higher, to avoid the danger that the weakest cell might fall below the critical 1 V point when being discharged.

Our own experience shows that deep-discharges are not so critical if they are caused by the idle currents of electronic circuits (speed controller not disconnected from the flight battery after the flight; balancers powered by the battery and not removed after discharging the pack; in the present case with a LiPoRx, whose capacity was not refreshed in time). However, if you discover a battery in this condition, charge it initially using a very low current (1/20C or less) until it reaches a voltage within the “working window” of the cells (for Li-Po cells that is 3.0 … 4.2 Volts).

- Since we are not in a position to ensure the proper use of the cells, the user is deemed to have accepted the responsibility once he opens the sales package. Thereafter he has no claim against the manufacturer, the importer, the dealer or the employees of those companies if an accident occurs in which personal injury or property damage result.

13.3 Cell handling

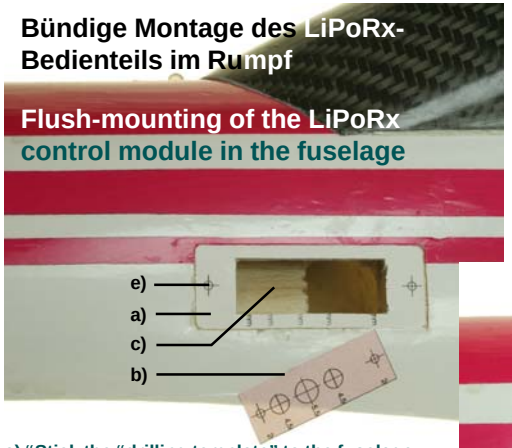
- The voltage of brand-new cells and discharged cells is not zero; it is generally more than 3 Volts. Short-circuit hazard!
- Never place cells or batteries on a conductive surface. Note that carbon fibre fuselages and carbon fibre spars are conductive!
- Do not place batteries in an oven or micro-wave oven!
- Schulze battery packs are protected at many points against accidental short-circuit, using cover plates, silicone, fabric tape and heat-shrink sleeving. Take care to avoid short-circuits at any unprotected points, and keep an eye open for abraded areas of the heat-shrink sleeving; if you discover a weak point, insulate it thoroughly.
- Keep individual cells and battery packs well away from youngsters, and store them out of the reach of children at all times. Many cells look rather like chewing gum or chocolate bars, and this is potentially confusing and dangerous.
- Do not open cells. The internal chemicals react with oxygen in the air and / or water, and in some circumstances the reaction can be violent. If a cell should catch fire and you have no suitable extinguishing agent to hand (sand, extinguisher powder), allow it to burn out, taking care not to breathe in the vapours generated by the fire.
- If the chemicals make contact with your eyes, immediately wash it off using plenty of water, and seek the assistance of a specialist doctor.
- The manufacturer's stated maximum discharge rates may be greatly exceeded when the cells are in use (typical of RC usage), which means that the cells are working under experimental conditions. As a result the manufacturer, the importer and the dealer are not liable for any claim under guarantee in respect of capacity, useful life, storage and discharge characteristics.
  Due to the protective circuits of the LiPoRx the cells usually cannot be overloaded.

13.4 Disposal

- Discharge the cells of the LiPoRx by switching on the LiPoRx.
  If you want to dispose single cells discharge them slowly, ideally using a 1 … 10 kOhm resistor, which you can leave attached to the empty cells.
- Take the dead, discharged cells to your local battery collection point; packs purchased from us can also be returned to us.
- If the electronics of the LiPoRx is in good working condition it is possible to change only the battery cells of the LiPoRx in our service.

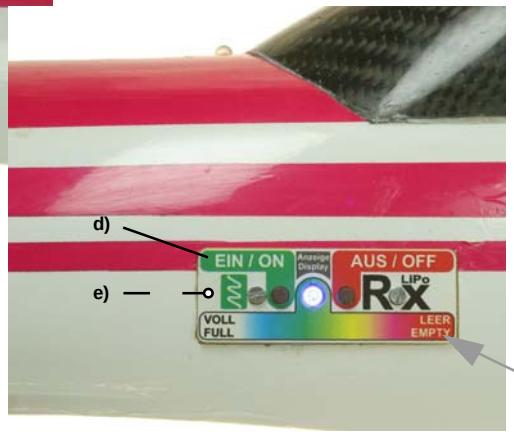
Bündige Montage des LiPoRx-Bedienteils im Rumpf

Flush-mounting of the LiPoRx control module in the fuselage



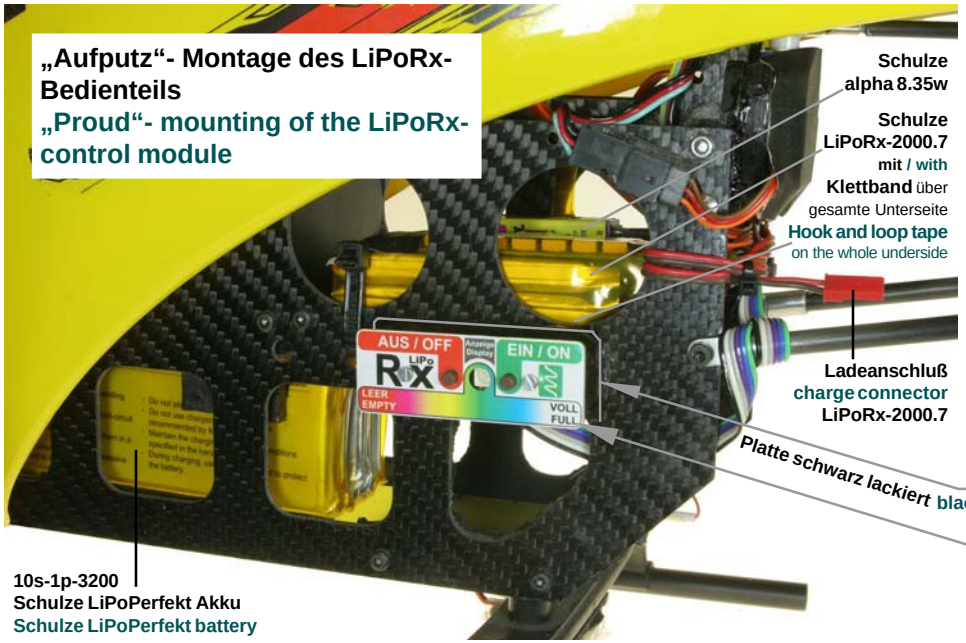
a) "Stick the "drilling template" to the fuselage and
b) remove the inner area of the template (different colour).
c) Cut the opening in the fuselage side.
(The picture shows a twin-wall fuselage, for which a smaller inner cut-out for the cable to the battery is sufficient)
d) Glue the prepared control module to the fuselage or
e) secure it using the two outer holes.

a) "Bohrschablone" auf den Rumpf aufkleben und
b) farblich abgesetzten inneren Ausschnitt der Schablone entfernen.
c) Ausbruch in die Rumpfwand schneiden.
(Im Bild ist ein Doppelwand-Rumpf abgebildet der mit einem kleineren inneren Ausschnitt für das Verbindungskabel zum Akku auskommt)
d) Vormontiertes Bedienteil auf den Rumpf kleben oder
e) durch eventuell durch die äußeren beiden Löcher festschrauben.



„Aufputz"- Montage des LiPoRx-Bedienteils

„Proud"- mounting of the LiPoRx-control module



Schulze alpha 8.35w

Schulze LiPoRx-2000.7 mit / with Klettband über gesamte Unterseite
Hook and loop tape on the whole underside

Ladeanschluß charge connector LiPoRx-2000.7

Platte schwarz lackiert black coloured plate

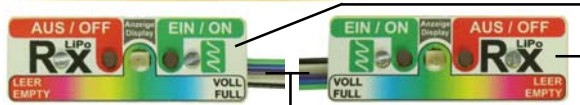
10s-1p-3200
Schulze LiPoPerfekt Akku
Schulze LiPoPerfekt battery

Steckverbinder zum Bedienteil
Connector of control module

Anschlußkabel (siehe unten)
Connecting cables (see below)

Front-Aufkleber / Front cover
Typ "EIN rechts" / Type "ON right"

Front-Aufkleber / front cover
Typ "EIN links" / Type "ON left"



Konfigurations-Löt-Pads
Configuration solder pads

Lade-Anschluß
Charge connector

Empfänger-Anschluß 1
Receiver connector 1

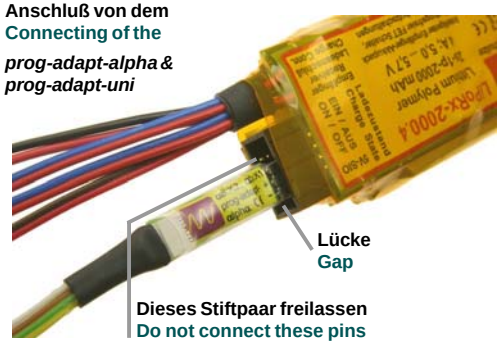
Empfänger-Anschluß 2
Receiver connector 2

Hochstrom-Anschluß*
High current connector*
*~~LiPoRx910.x~~

Stückliste Bedienteil / parts list control module
1 Elektronik / electronics
2 Front-Klebefolien / Front covers (left & right)
1 Klebefolie Bohrschablone / Drilling template
1 GFK-Frontplatte / GRK front plate 0,5 mm
1 GFK Frontplatte / GRK front plate 1,0 mm
2 Schrauben / screws M2 * 18
2 Schrauben / screws M2 * 10
2 Stopp-Muttern / self-locking nuts M2
2 Abstandshülsen / spacers 4,5 mm
2 Abstandshülsen / spacers 7,0 mm

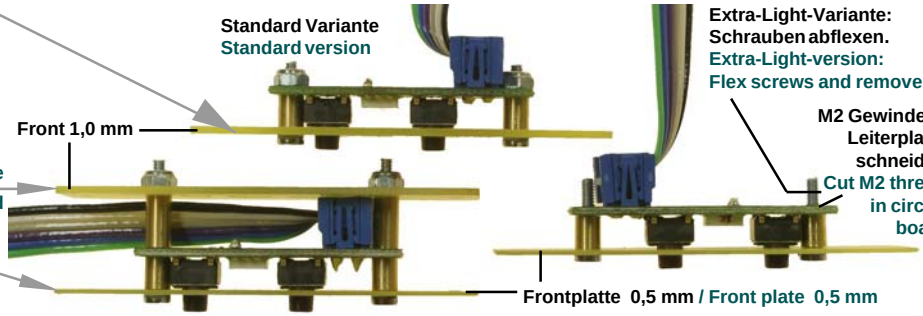
Sonstiges - nicht enthalten
Miscellaneous - not included
Bohrer / Drill 2,0 ... 2,2 mm oder für / or for extra-Light-Version: M2 Gewindeschneider / tap

Anschluß von dem
Connecting of the
prog-adapt-alpha &
prog-adapt-uni



Lücke
Gap

Dieses Stiftpaar freilassen
Do not connect these pins



Standard Variante
Standard version

Front 1,0 mm

Extra-Light-Variante:
Schrauben abflexen.
Extra-Light-version:
Flex screws and remove.

M2 Gewinde in Leiterplatte schneiden
Cut M2 thread in circuit board

Frontplatte 0,5 mm / Front plate 0,5 mm